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SPE-Paper No. 14297

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Description

The present invention relates to an apparatus for taking a core sample from a formation, as set forth in the preamble of claim 1.

In use of such apparatus (SPE-Paper No. 14297) drilling fluid discharges not only from the discharge apartures in the bit face but also adjacent the core from a gap between the core bit and the inner tube assembly to lubricate an inner chisel at the lower end of the inner tube and the gage cutting portions of the bit including surface-set diamonds as cutters.

Fluid discharge for lubrication is generally required in known conventional coring apparatus (US-A-1 506 119), 2 373 323, 4 606 416) some of which utilize a core bit having discrete cutters disposed thereon (US-A-2 070 001).

The disadvantages of these conventional systems are substantial, particular when coring is performed in relatively soft to medium hard, or unconsolidated formations. For example, the abrasive cutting of the surface-set diamonds on the inner gage of the bit puts substantial strain on the relatively fragile core produced from a soft to medium hard formation, promoting breakage of the core. Such core breakage, in addition to being damaging to the core, and thereby to its value as a formation indicator, will also frequently cause core jamming in the core barrel, leading to a premature and undesired end to the coring operation. Additionally, and critically, the fluid discharge required for lubrication of the gage cutting section promotes fluid invasion of a fractured or permeable core, again promoting deterioration of the core, both structurally and, most importantly, as a formation sample. This fluid invasion of the core is a major problem and may be especially severe with particular types of drilling fluids.

Object of the present invention is to provide an apparatus of the kind referred to minimizing the mechanical strains and fluid invasion of the core.

A coring apparatus in accordance with claim 1 of the present invention minimizes the exposure of the core to drilling fluids and ensures a highly accurate cutting of the core sample exterior with reduced risk of mechanical-induced destruction of the core.

Further preferred embodiments are characterised in claims 2-15 and can best be understood by now turning to the following description and the following drawings.

Figure 1 depicts an exemplary embodiment of a core barrel in accordance with the present invention, illustrated partially in vertical section.

Figure 2 depicts a portion of the coring bit and coring shoe of the core barrel of Figure 1, illustrated in vertical section.

Figure 3 depicts the core bit and core shoe of Figure 1 from a lower plan view.

Figure 4 depicts an alternative embodiment of a core bit and core shoe for use in accordance with the present invention.

Figure 5 depicts an exemplary alternative configuration for a core shoe/cutter assembly in accordance with the present invention, depicted partially in vertical section.

Figure 6 depicts an exemplary alternative configuration for a core shoe/cutter assembly in accordance with the present invention, depicted partially in vertical section.

Figure 7 depicts an exemplary alternative configuration for a core shoe/cutter assembly in accordance with the present invention, depicted partially in vertical section.

Figure 8 depicts an exemplary alternative configuration for a core shoe/cutter assembly in accordance with the present invention, depicted partially in vertical section.

Referring now to Figure 1 of the drawings, therein is depicted a core barrel assembly 10 in accordance with the present invention. Core barrel assembly 10 includes a core shoe/bit assembly, indicated generally at 12. Much of core barrel assembly 10 functions in a conventional manner. Briefly, core barrel assembly 10 includes an outer tube or housing assembly 14 and an inner tube assembly 16. Outer tube assembly 14 is coupled to the drill string (not illustrated), by a safety joint assembly, indicated generally at 18. Outer tube assembly 14 preferably includes stabilizers 20 and 22 on its exterior to stabilize core barrel 10 and to prevent bit wobble. Inner tube assembly 16 is rotatably coupled relative to outer tube assembly 14 by a swivel assembly 24.

Core barrel assembly 10 includes provisions for flushing and cleaning of the bottom of the hole prior to coring. Specifically, inner tube assembly 16 includes a fluid passageway 30. Passageway 30 is closable by means of a drop ball 32 adapted to cooperate with a ball seat 34. Landing of ball 32 on seat 34 will close a lower portion 30a of passageway 30 and cause fluid to pass through apertures 36 in inner tube assembly 16 and to pass through annulus 38 to exit through discharge apertures 40 in coring bit 48. Thus, prior to the landing of ball 32, fluid can be circulated down through passageway 30 and up around the exterior of core barrel assembly 10. The landing of ball 32 diverts the fluid flow, as described above, and readies the assembly for coring.

Core shoe/bit assembly 12 is located at the bottom end of core barrel 10, and includes core shoe 46 and core bit 48. Core shoe 46 is coupled at the lower end of inner tube assembly 16. Core bit 48 is coupled at the lower end of outer tube

assembly 14, for rotation therewith. Core shoe 46 includes a tapered recess 47 which houses a retention ring 49. Retention ring 49 is a conventional member which is adapted to move longitudinally in tapered recess 47, and which includes a plurality of surfaces adapted to grip a core and to retain it as ring 49 moves downwardly in core barrel assembly 10, most commonly known as a slip type core catcher.

Referring now also to Figures 2 and 3, in each Figure are depicted portions of coring shoe 46 and core bit 48 in greater detail. Those skilled in the art will recognize that core bit 48 can be one of a variety of shapes. Core bit 48 preferably includes a body member having a generally parabolic outer profile, indicated generally at 51. Alternatively, other profiles can be utilized to advantage. As an example, generally flat sides, giving the bit a generally conical form may be utilized. Core bit 48 includes a plurality of passageways 52 which provide fluid communication between annulus 38 and discharge apertures 40 in the face of bit 48. A plurality of cutters 54 are preferably distributed along the profile of bit 48. Cutters 54 are preferably polycrystalline diamond compact (PDC) cutters, or large thermally stable synthetic diamond product (TSP) cutters which are available in similar sizes and shapes to PDC's, or mosaic-type cutters comprising smaller thermally stable synthetic diamond products (TSP's) arranged in a pattern to simulate a larger, unitary cutter; and may be distributed in any suitable arrangement across body member 56 of bit 48.

Body member 56 preferably includes a lower bore 57. At least one cutter 54a, and preferably two or three such cutters, 54b, 54c extend inwardly of the surface defining bore 57 of core bit 48 to cut an inside gage, i.e., the external diameter of the core 53. Cutters 54a-c may be secured to body member 56 by conventional means, such as being bonded into a matrix or mounted through use of studs. Each individual gage cutting element 54a, 54b, 54c is preferably formed with a flat 64 at this gage dimension. This flat 64 assures that as cutting elements 54a-c start to wear, the gage of the core will be cut to a uniform dimension. Thus, the interior gage of bit 48 (the exterior gage of the core), as established by flats 64, is offset form the dimension of body member 56 of bit 48. This allows bit 48 to accommodate an annular lip or pilot section 62 of core shoe 56 within the dimension provided by cutters 54a, 54b, 54c between flats 64 and surface 57.

In the depicted preferred embodiment, core bit 48 includes a shelf 58 on its inner surface. Shelf 58 is disposed at an angle to the axis of bit 48. Core shoe 46 includes a bearing surface 60 which is preferably adapted to contact shelf 58 and to thereby form a fluid restriction, or, ideally, a fluid seal between the rotating bit and the stationary core barrel. Pilot section 62 extends downwardly from bearing surface 60 and is adapted to lie proximate gage cutters 54a-c. In the embodiment of Figures 1-3, gage cutters 54a-c have an angled flat 66 formed on their upper half. Pilot section 62 extends with a complementary angled surface 68 to lie proximate flat 66. Pilot section surface 68 will preferably lie within approximately 1,27 cm (.5 inch) of flat 66, and most preferably will lie within approximately 0,127 cm (.050 inch) to 0,0254 cm (.010 inch) of flats 66. As can be seen in Figure 2, the engagement of pilot section bearing surface 60 with shelf 58 serves to limit travel of pilot section 60 to maintain the desired stand-off between surface 68 and flats 66 on cutters 54a-c. Although parallel flat surfaces 66 and 68 are shown in gage cutter 54a and pilot section 62, respectively, other generally complimentary surfaces may be utilized, such as generally concentric curvilinear surfaces, etc.

In operation, as depicted in Figure 2, core shoe/bit assembly 12 provides substantial functional advantages over prior art systems. As bit 48 is rotated within the formation, cutters 54 will cut the formation, and cutters 54a-c will cut the exterior gage of the core. As the core is cut, it immediately and directly enters core shoe 46. Accordingly, there is no additional gage cutting section which exerts mechanical stress on the core. Additionally, because there is no extensive gage cutting section, there is not a need for fluid adjacent the cut core. This, very importantly, substantially prevents fluid invasion of the core. As previously described, surfaces 58 and 60 (of bit 48 and core shoe 46, respectively), cooperatively form a fluid restriction, or preferably a fluid seal. Accordingly, drilling fluid is directed from annulus 38 through passages 52 to face discharge apertures 40. Thus, the fluid is not discharged proximate the core, as is typical of conventional systems. Additionally, the relatively steep parabolic profile of bit 48 facilitates both improved flushing of cuttings away from the bit and improved movement of cutting fluid away from where the core is being formed from the virgin formation. The cut core is thus protected from fluid invasion by both avoiding the directing of an appreciable amount of drilling fluid past the cut core, and by directing the fluid primarily away from the core as it is cut.

As previously described, core barrel assembly 10 is a mechanically-actuable assembly, adapted to retain a core by mechanically gripping the exterior of the core. It should be understood that the present invention may also be utilized with other types of core barrel assemblies, including hydraulically-actuable and/or full closure core barrels, as

disclosed in U.S. Patents Nos. 4,552,229 and 4,553,613.

Referring now to Figure 4, therein is depicted a representative portion of an alternative embodiment of a core shoe/bit assembly 80. Core shoe/bit assembly 80 functions very similarly to core shoe/bit assembly 12, accordingly only the essential differences in structure will be discussed herein. Core shoe/bit assembly 80 is representative of one of a variety of assemblies which may be designed and utilized. Each gage cutter 84 of core shoe/bit assembly 80 is conformed to include a tapered area with a long flat 86 on its inner surface. Flats 86 are angularly disposed relative to the longitudinal axis of the core barrel assembly. A pilot section 82 of core shoe 87 is cooperatively conformed with a tapered portion 88, having a surface 90 adapted to lie generally proximate and parallel to surface 86 of cutter 84. Thus, in this embodiment, core shoe 87 extends not only within a dimension established by gage cutter(s) 84, but also extends longitudinally for a significant distance beneath the upper dimension (or surface) 88 of cutter(s) 84. Gage cutter 84 may be again formed of a PDC, large TSP, mosaic or similar material adapted to provide the desired shape.

Referring now to Figures 5-8, therein are depicted exemplary cutter constructions and core shoe/cutter relationships which may be utilized in accordance with the present invention. Figure 5 depicts a cutter assembly 90 and the pilot portion of a core shoe 92. Cutter assembly 90 is a composite mosaic cutter formed of a plurality of discrete thermally stable diamond cutting elements 98, bonded together to effectively form a single cutting element. As with previous embodiments, cutter assembly 90 includes a generally flat interior surface 94 to cut the exterior gage of the core. Cutter assembly 90 includes an upper "notch" 96 to receive tip 98 of core shoe 92 having its lowermost dimension adjacent sidewall 99 of the bit.

Figure 6 depicts a cutter assembly 100 which includes a polycrystalline diamond cutter 102 and a mosaic cutter assembly portion 104. Polycrystalline diamond cutter 102 may be a conventional "half-round" shape or other portion of a hemispherical section. Mosaic cutting section 104 extends generally vertically, again to cut the gage of a core, and forms a generally L-shaped shelf 106 to receive lower end of core shoe 108. Alternatively, one or more thermally stable diamond disc cutters could be coupled to a mosaic cutting section.

Figure 7 depicts a PDC-type cutter, such as, for example, a 1,27 cm (half-inch) or larger PDC cutter 110 which includes a curvilinear, or generally J-shaped, notch 112 adapted to receive the rounded tip 114 of a core shoe. Cutter 110 again includes a flat 116 adjacent notch 112.

Figure 8 depicts a PDC-type cutter 120 which is generally rectangular in shape, with the exception of having an upper interior corner "cropped" to form an angled surface 122 adapted to cooperatively accommodate a tip 124 of the core shoe.

As can be seen in each of the embodiments of Figures 5-8, the pilot section of the core shoe is preferably received within the dimension established by the gage cutters between the interior cutting surface of the cutter (preferably a flat), and the sidewall of the adjacent portion of the core bit. With each of the embodiments of Figures 5-8, the clearances between the core shoe and the gage cutters will preferably be similar to those described earlier herein, i.e., preferably less than 1,27 cm (.5 inch), and most preferably, 0,127 cm to 0,0254 cm (.050 to .010 inch).

Many modifications and variations may be made in the techniques and structures described and illustrated herein without departing from the spirit and scope of the present invention. For example, as noted previously, hydraulically operated and/or full closure core barrel assemblies may be utilized to retain the cores. Additionally, and also by way of example only, many different types of cutter types and configurations may be utilized on coring bits for use with the present invention. Also, as can be seen from the depicted configurations and constructions of cutters and core shoes a virtually endless variety of geometric configurations of cutters and cooperative forms of core shoes may be utilized in accordance with the present invention. As discussed herein, the cutters may be relatively large discrete cutting elements, may be composite cutting elements, or may be combinations of both types. Accordingly, it should be readily understood that the described embodiments are illustrative only, and are not to be considered as limitations upon the scope of the present invention.

Claims

1. An apparatus (10) for taking a core sample (53) from a formation including an outer housing assembly (14) and an inner tube assembly (16) rotatably disposed within the outer housing assembly (14), the outer housing assembly (14) and inner tube assembly (16) defining a recess (38) therebetween for conducting flow of drilling fluid to passageways (52) in a core bit (48) fixed to the lower end of the outer housing assembly (14), said fluid flow exiting the passageways (52) from discharge apertures (40) in the face of core bit (48), core bit (48) having a bore (57) therethrough in communication with the inner tube assembly (16), the apparatus characterized by: at least one discrete cutter (54,84,91,100,110,120) disposed

on said core bit (48) adjacent the lower end of bore (57) for cutting the core sample (53) to an exterior dimension for receipt within the inner tube assembly (16); and the lower end of the inner tube assembly (16) and the interior of the core bit (48) being cooperatively configured to provide a restriction to entry by fluid flow from the recess (38) into the interior of the inner tube assembly (16), while the core sample (53) is being taken by rotation of said outer housing assembly (14) and said core bit (48) relative to said inner tube assembly (16).

2. The apparatus (10) of claim 1, wherein the inner tube assembly (16) includes a core shoe (46) having a first component (60) and the core bit (48) includes a second, cooperating component (58) for effecting the restriction to fluid flow from the recess (38).

3. The apparatus (10) of claim 1, wherein the lower end of the inner tube assembly (16) is located proximate the at least one discrete cutter (54,84,91,100,110,120).

4. The apparatus (10) of claim 3, wherein the lower end of the inner tube assembly (16) and the at least one discrete cutter (54,84,91,100,110,120) are positioned within approximately 1,27 cm (0,50 inches) of one another as the core sample (53) is cut.

5. The apparatus (10) of claim 3, wherein the lower end of the inner tube assembly (16) and the at least one discrete cutter (54,84,91,100,110,120) are positioned within a range of approximately 0,0254 to 0,127 cm (0,010 to 0,050 inches) of one another as the core sample (53) is cut.

6. The apparatus (10) of claim 1, wherein said at least one discrete cuter (54,84,91,100,110,120) has, at least initially, a partially curvilinear cutting surface.

7. The apparatus (10) of claim 1, wherein said at least one discrete cutter (54,84,91,100,110,120) includes a flat (64,86,94,104,116) to cut the exterior dimension of the core sample (53).

8. The apparatus (10) of claim 7, wherein the flat (64,86,94,104,116) is oriented substantially parallel to the longitudinal axis of the apparatus (10).

9. The apparatus (10) of claim 1, wherein the at least one discrete cutter (54,84,100,120) includes a tapered section with a surface (66,86,106,122) angularly disposed relative to the longitudinal axis of the inner tube assembly (16), and the lower end of the inner tube assembly (16) has a surface (68,90,108,124) oriented to lie adjacent angularly disposed surface (66,86, 106,122) on the discrete cutter (54,84,100,120).

10. The apparatus (10) of claim 1, wherein the at least one discrete cutter (54,84,91,100,110,120) includes a polycrystalline diamond cutting surface.

11. The apparatus (10) of claim 1, wherein the at least one discrete cutter (54,84,91,100,110,120) includes a thermally stable synthetic diamond cutting surface.

12. The apparatus (10) of claim 1, wherein the inner tube assembly (16) includes a core shoe (46,87) having a pilot section (62,82) which extends at least partially into bore (57) of core bit (48).

13. The apparatus (10) of claim 12, wherein the pilot section (62,82) extends longitudinally downward to a position proximate at least the uppermost extent of the at least one discrete cutting element (54,84,91,100,110,120).

14. The apparatus (10) of claim 13, wherein the tip of the pilot section (62,82) and the at least one discrete cutter (54,84,91,100,110,120) are cooperatively configured.

15. The apparatus (10) of claims 1 through 14, wherein said at least one discrete cutter comprises a plurality of discrete cutters (54,84,91,100, 110,120) circumferentially spaced about said bore (57).

Patentansprüche

1. Gerät (10) zur Entnahme einer Kernprobe (53) aus einer Formation, mit einer äußeren Gehäuseeinheit (14) und einer inneren Rohreinheit (16), die drehbar innerhalb der äußeren Gehäuseeinheit (14) angeordnet ist, wobei die äußere Gehäuseeinheit (14) und die innere Rohreinheit (16) zwischen sich einen Spalt (38) für die Leitung der Rohrspülungsflüssigkeit zu Durchlässen (52) in einem Kernbohrmeißel (48) begrenzen, der am unteren Ende der äußeren Gehäuseeinheit (14) befestigt ist, wobei der Flüssigkeitsstrom aus den Durchlässen (52) an Auslaßöffnungen (40) in der Oberfläche des Kernbohrmeißels (48) austritt, und wobei der

Kernbohrmeißel (48) eine Bohrung (57) aufweist, die in Verbindung mit der Innenrohreinheit (16) steht, **dadurch gekennzeichnet,** daß zumindest ein gesonderter Schneidkörper (54,84,91,100,110,120) auf dem Kernbohrmeißel (48) nahe dem unteren Ende der Bohrung (57) zum Schneiden der Kernprobe (53) auf eine für die Aufnahme in der inneren Rohreinheit (16) passende Außendimension angeordnet ist, und daß das untere Ende der inneren Rohreinheit (16) und das Innere des Kernbohrmeißels (48) zusammenwirkend gestaltet sind zur Schaffung einer Beschränkung des Eintretens des Flüssigkeitsstromes aus dem Spalt (38) in das Innere der inneren Rohreinheit (16), während die Kernprobe (53) durch Drehen der äußeren Gehäuseeinheit (14) und des Kernbohrmeißels (48) relativ zur inneren Rohreinheit (16) genommen wird.

2. Gerät (10) nach Anspruch 1, bei dem die innere Rohreinheit (16) einen Kernschuh (46) mit einer ersten Komponente (60) und der Kernbohrmeißel (48) mit einer zweiten, zusammenwirkenden Komponente (58) für das Herbeiführen der Beschränkung der Flüssigkeitsströmung aus dem Spalt (38) versehen ist.

3. Gerät (10) nach Anspruch 1, bei dem das untere Ende der inneren Rohreinheit (16) nahe dem zumindest einen gesonderten Schneidkörper (54,84,91,100,110,120) angeordnet ist.

4. Gerät (10) nach Anspruch 3, bei dem das untere Ende der inneren Rohreinheit (16) und der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) in einem Abstand von annähernd 1,27 cm (0,50 Zoll) zueinander angeordnet sind, wenn die Kernprobe (53) geschnitten wird.

5. Gerät (10) nach Anspruch 3, bei dem das untere Ende der inneren Rohreinheit (16) und der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) in einem Abstand von annähernd 0,0254 bis 0,127 cm (0,010 bis 0,05 Zoll) zueinander angeordnet sind, wenn die Kernprobe (53) geschnitten wird.

6. Gerät (10) nach Anspruch 1, bei dem der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) zumindest anfangs eine bereichsweise bogenförmige Schneidfläche aufweist.

7. Gerät (10) nach Anspruch 1, bei dem der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) eine Flachseite (64,86,94,104,116) zum Schneiden der Außenabmessung der Kernprobe (53) aufweist.

8. Gerät (10) nach Anspruch 7, bei dem die Flachseite (64,86,94,104,116) im wesentlichen parallel zur Längsachse des Gerätes (10) ausgerichtet ist.

9. Gerät (10) nach Anspruch 1, bei dem der zumindest eine gesonderte Schneidkörper (54,84,100,120) einen konischen Abschnitt mit einer Fläche (66,86,106,122) aufweist, die winklig zur Längsachse der inneren Rohreinheit (16) angeordnet ist, und das untere Ende der inneren Rohreinheit (16) eine Fläche (68,90,108,124) hat, die so ausgerichtet ist, daß sie an die winklig ausgerichtete Fläche (66,86,106,122) am gesonderten Schneidkörper (54,84,100,120) angrenzend gelegen ist.

10. Gerät (10) nach Anspruch 1, bei dem der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) eine polycristalline Diamantschneidfläche aufweist.

11. Gerät (10) nach Anspruch 1, bei dem der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) eine thermostabile synthetische Diamantschneidfläche aufweist.

12. Gerät (10) nach Anspruch 1, bei dem die innere Rohreinheit (16) einen Kernschuh (64,87) mit einem Pilotabschnitt (62,82) aufweist, der sich zumindest teilweise in die Bohrung (57) des Kernbohrmeißels (48) erstreckt.

13. Gerät (10) nach Anspruch 12, bei dem sich der Pilotabschnitt (62,82) in Längsrichtung abwärts in eine Stellung nahe der höchsten Erstrekkung des zumindest einen gesonderten Schneidkörpers (54,84,91,100,110,120) erstreckt.

14. Gerät (10) nach Anspruch 13, bei dem die Spitze des Pilotabschnitts (62,82) und der zumindest eine gesonderte Schneidkörper (54,84,91,100,110,120) eine zuzsammenwirkende Formgebung aufweisen.

15. Gerät (10) nach Anspruch 1 bis 14, bei dem der zumindest eine gesonderte Schneidkörper eine Mehrzahl von gesonderten, in Umfangsrichtung im Abstand um die Bohrung (57) herum angeordneten Schneidelementen (54,84,91,100,110,120) besteht.

Revendications

1. Appareil (10) pour prélever un échantillon carotté (53) d'une formation comprenant un fût extérieur (14) et un tube intérieur (16) monté à rotation à l'intérieur du fût extérieur (14), le fût extérieur (14) et le tube intérieur (16) définissant entre eux un creux (38) pour canaliser le fluide de £orage qui s'écoute vers des passages (52) dans un trépan carottier (48) fixé à l'extrémité inférieure du fût extérieur (14), le fluide de forage sortant des passages (52) par des orifices de débit (40) prévus dans la face du trépan carottier (48), le trépan carottier (48) présentant un alésage (57) qui le traverse de part en part et qui est en communication avec le tube intérieur (16), l'appareil étant caractérisé par :
   au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) disposé sur le trépan carottier (48) à proximité de l'extrémité inférieure de l'alésage (57) pour tailler l'échantillon carotté (53) en une dimension extérieure permettant sa réception dans le tube intérieur (16), et
   l'extrémité inférieure du tube intérieur (16) ainsi que l'intérieur du trépan carottier (48) sont agencés conjointement afin d'offrir un étranglement à une entrée du flux de fluide provenant du creux (38) à l'intérieur du tube intérieur (16), tandis que l'échantillon carotté (53) est prélevé par rotation du fût extérieur (14) et du trépan carottier (48) par rapport au tube intérieur (16).

2. Appareil (10) suivant la revendication 1, dans lequel le tube intérieur (16) comprend un sabot à carotte (46) comportant un premier élément (60) et le trépan carottier (48) comprend un second élément coopérant (58) destiné à créer l'étranglement à l'écoulement du fluide provenant du creux (38).

3. Appareil (10) suivant la revendication 1, dans lequel l'extrémité inférieure du tube intérieur (16) est disposée à proximité dudit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120).

4. Appareil (10) suivant la revendication 3, dans lequel l'extrémité inférieure du tube intérieur (16) et ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) sont placés à moins d'environ 1,27 cm (0,50 pouce) l'un de l'autre lorsque l'échantillon carottier (53) est prélevé.

5. Appareil (10) suivant la revendication 3, dans lequel l'extrémité inférieure du tube intérieur (16) et ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) sont installés dans un intervalle d'environ 0,0254 à 0,127 cm (0,010 à 0,050 pouce) l'un de l'autre lorsque l'échantillon carotté (53) est prélevé.

6. Appareil (10) suivant la revendication 1, dans lequel ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) présente, au moins initialement, une surface de coupe partiellement courbe.

7. Appareil (10) suivant la revendication 1, dans lequel ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) comprend un méplat (64, 86, 94, 104, 116) destiné à tailler la dimension extérieure de l'échantillon carotté (53).

8. Appareil (10) suivant la revendication 7, dans lequel le méplat (64, 86, 94, 104, 116) est orienté en substance parallèlement à l'axe longitudinal de l'appareil (10).

9. Appareil (10) suivant la revendication 1, dans lequel ledit au moins un élément de coupe discret (54, 84, 100, 120) comprend une section biseautée avec une surface (66, 86, 106, 122) disposée angulairement par rapport à l'axe longitudinal du tube intérieur (16) et l'extrémité inférieure du tube intérieur (16) présente une surface (68, 90, 108, 124) orientée de manière à être adjacente à la surface angulaire (66, 86, 106, 122) prévue sur l'élément de coupe discret (54, 84, 100, 120).

10. Appareil suivant la revendication 1, dans lequel ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) comprend une surface de coupe en diamant polycristallin.

11. Appareil (10) suivant la revendication 1, dans lequel ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) comprend une surface de coupe en diamant synthétique thermiquement stable.

12. Appareil (10) suivant la revendication 1, dans lequel le tube intérieur (16) comprend un sabot à carotte (46, 87) comportant une section pilote (62, 82) qui s'étend au moins partiellement dans l'alésage (57) du trépan carottier (48).

13. Appareil (10) suivant la revendication 12, dans lequel la section pilote (62, 82) s'étend lonqitudinalement vers le bas jusqu'à une position

située à proximité d'au moins l'étendue supérieure extrême dudit au moins un élément de coupe discret (54, 84, 81, 100, 110, 120).

14. Appareil (10) suivant la revendication 13, dans lequel l'extrémité de la section pilote (62, 82) et ledit au moins un élément de coupe discret (54, 84, 91, 100, 110, 120) sont de configurations coopérantes.

15. Appareil (10) suivant les revendications 1 à 14, dans lequel ledit au moins un élément de coupe discret comprend une pluralité d'éléments de coupe discrets (54, 84, 91, 10, 110, 120) espacés circonférentiellement autour de l'alésage (57).

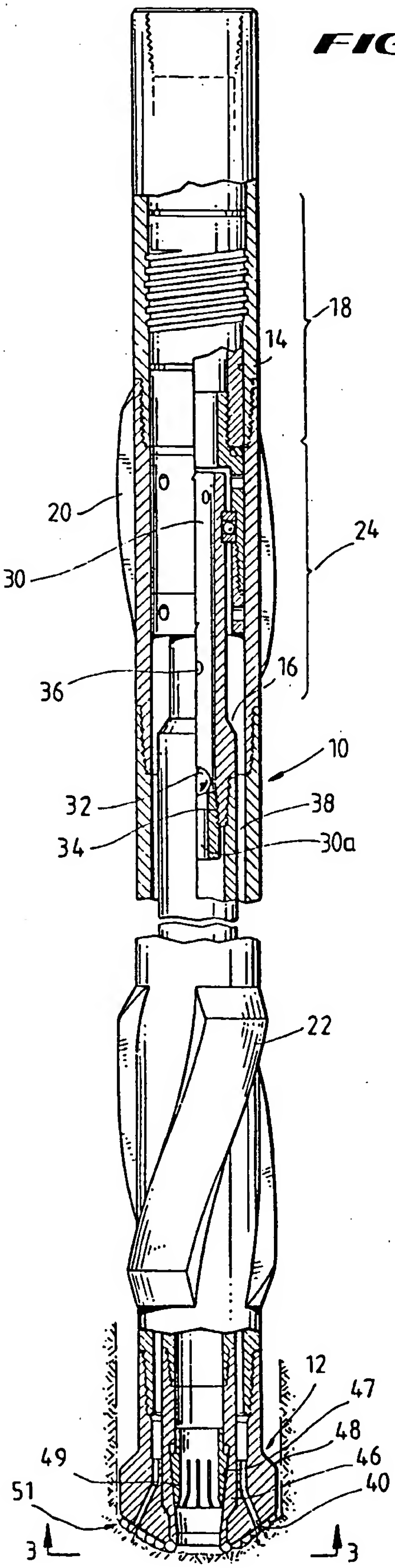

FIG.1

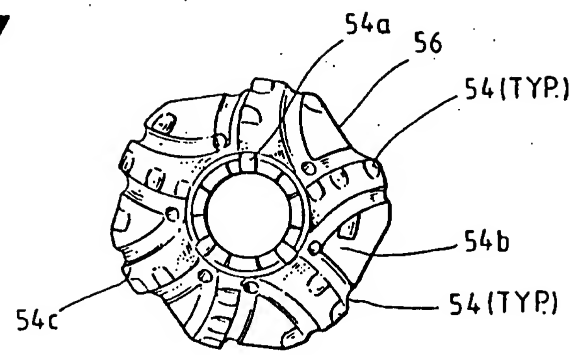

FIG.3

FIG.2

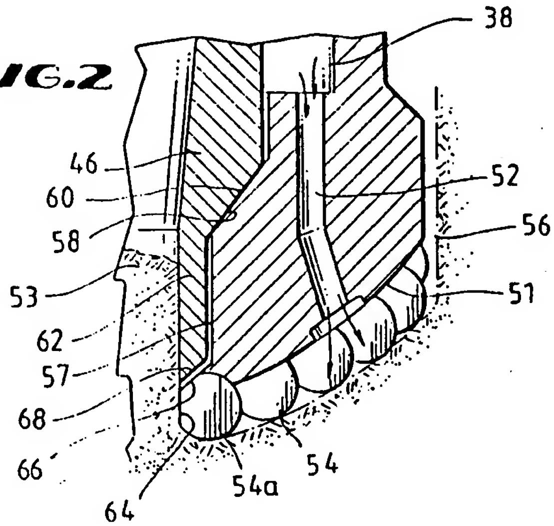

FIG.4

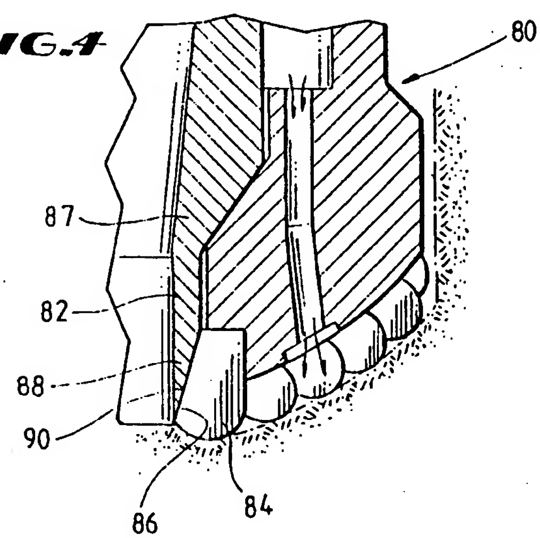

FIG.5

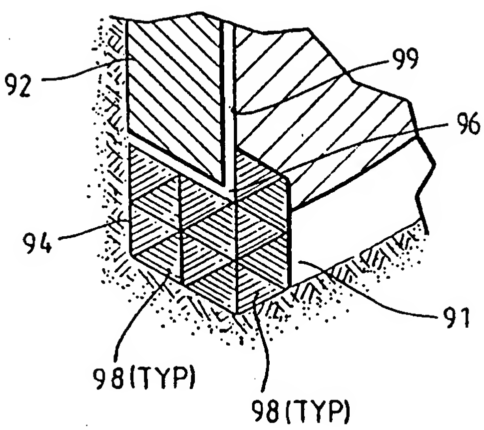

FIG.6

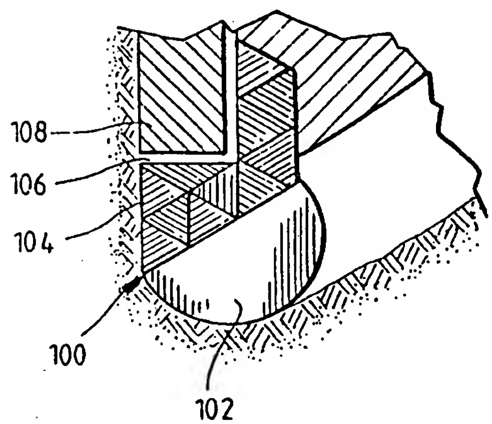

FIG.7

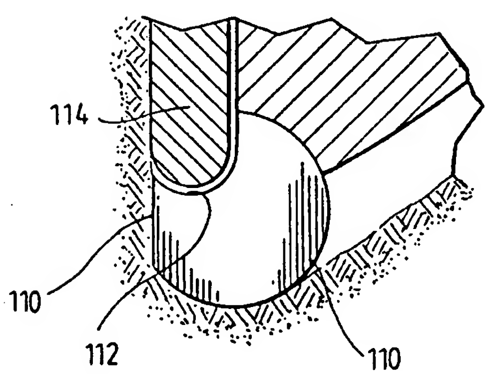

FIG.8